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ABSTRACT

Research on teacher thinking has established a place for itself within the international educational research enterprise. What is not so clear is how studies of teacher thinking may be of use in improving the quality of teacher preparation programs. This paper promotes a consultant role for researchers on teacher thinking in relation to teacher educators. The current state of knowledge about teacher thinking is summarized under three headings: Implicit Theories and Preconceptions, Planning and Reflection, and Uncertainty and Dilemmas. After each summary, a list of questions is offered as food for thought in pursuit of understanding and improving learning to teach. The author claims that research on teacher thinking can improve teacher preparation by encouraging thoughtful teacher educators to ask better questions of themselves and of their arts. A 55-item reference list is appended. (Author)

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Christopher M. Clark

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Abstract

Research on teacher thinking has established a place for itself within the international educational research enterprise. What is not so clear is how studies of teacher thinking may be of use in improving the quality of teacher preparation programs. This paper promotes a consultant role for researchers on teacher thinking in relation to teacher educators. The current state of knowledge about teacher thinking is summarized under three headings: Implicit Theories and Preconceptions, Planning and Reflection, and Uncertainty and Dilemmas. After each summary, a list of questions is offered as food for thought in the pursuit of understanding and improving learning to teach. The author claims that research on teacher thinking can improve teacher preparation by encouraging thoughtful teacher educators to ask better questions of themselves and of their arts.

ASKING THE RIGHT QUESTIONS ABOUT TEACHER PREPARATION: CONTRIBUTIONS OF RESEARCH ON TEACHER THINKING[1]

Christopher M. Clark[2]

The field of research on teaching thinking is thriving and growing. But what is not so clear is how (or whether) this research can be informative and useful to teacher educators. What conditions must be satisfied in order to move from the literature on teacher thinking to more thoughtful practice of teacher education? And what first steps have already been taken to realize some of the practical promise of teacher thinking research? This paper addresses these questions within the larger framework of the relationship between research and practice in education.

There are three ways to characterize the relationship between research on teaching, on the one hand, and teacher education, on the other hand. In the worst case, research on teaching has no relationship at all to the practice of teacher education. Researchers pursue their own narrow and parochial interests, publish in obscure language in obscure journals, and avoid all discussion of practical implications of their work. For their part, teacher educators see this kind of research as irrelevant and impossible to understand, and continue to use unexamined habits and traditional ways of preparing teachers.

A second and better kind of relationship between research on teaching and teacher education follows from research in the process-product

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[1] This paper was presented at the third Conference on Teacher Thinking and Professional Action sponsored by the International Study Association on Teacher Thinking at Leuven University, Belgium, on October 16, 1986.

[2] Christopher Clark is coordinator of the Written Literacy Forum and professor of educational psychology at Michigan State University.

tradition. Teacher effectiveness researchers see their role as discovering those behaviors, skills, patterns, and strategies that lead to improved student learning and achievement. In this framework, the implications for teacher education are rather direct: Train prospective teachers to behave in the ways that research has shown to be most effective in producing achievement gains in students. The principal role of the teacher educator in this relationship is that of trainer of students in the skills and strategies documented by the research community. This is an essentially top-down model in which researchers and the knowledge they produce govern the content and practice of teacher preparation.

In this second kind of relationship between research and practice there are teacher educators who have read one or two reviews of the literature of teacher thinking, who have attended conference presentations of this research, or who have colleagues who are engaged in studies of teacher thinking. These teacher educators may have a felt sense that there is some potential in this work for affecting their conduct of teacher preparation, but may not know quite what to do about it. Some are awaiting a hypothetical "Phase 2" of research on teacher thinking, when researchers move from description of the ways teachers think to quasi-experiments and other tough-minded designs from which prescriptions will flow for how teachers ought to think, plan, and decide. In my opinion these teacher educators wait in vain. Research on teacher thinking will never provide a scientific basis for prescribing how teachers ought to think.

I want to propose a third kind of relationship between research on teaching (particularly research on teacher thinking) and the practice of teacher education. In this relationship members of the research community behave as <u>consultants</u> to the community of teacher educators. To work well

as a consultant one must come to see the client's (teacher educator's) problems from the perspective of a sympathetic outsider. A good consultant has expertise and a perspective different from that of the client and engages this expertise in the service of the client's own short and long term ends. A consultant seldom solves major problems but often contributes important pieces to the client's own solutions. The best consultants are those who leave us with something interesting and provocative to think about as we continue to wrestle with the complexities of our own local problematic situation. What I am calling for here is a more humble and service-oriented role for research on teaching in relation to teacher education--a relationship in which researchers provide food for thought responsive to the perceived needs of teacher educators. It is in this kind of a relationship that I see great promise for research on teacher thinking as a source of valuable assistance in the thoughtful preparation of teachers.

In this third kind of relationship we have teacher educators who have learned a bit about research on teacher thinking, who have the felt sense that something ought to be done with this work, and who have begun to think about their teaching of novices in light of new descriptions of the way teaching is. These teacher educators are not waiting for reseachers to tell them what to do next. Some have begun applied research programs of their own. Others have begun to make small changes in the content of their teaching and in the ways that they teach. Still others have begun the demanding and politically complicated process of reorganizing whole teacher preparation programs to reflect their collective and emergent sense of what constitutes progress in teacher education. These are the leaders and risk takers in teacher education to whom research on teacher thinking can be most useful.

Four General Claims

Given this way of thinking about the relationship of research and practice, I have four general claims to make about the promise of research on teacher thinking for influencing teacher education:

1. Research on teacher thinking has small but important contributions to make to the practice of teacher education. I do not see in research on teacher thinking the grounds for radical revision of the form and content of teacher preparation. Some of the most important contributions to teacher education may take the form of rationalizing, justifying, and understanding practices which have long been in place in teacher education. Furthermore, many contributions of research on teacher thinking will not make teacher education easier, but they may make teacher preparation more interesting.

2. The study of the thoughts, knowledge, and dispositions of experienced teachers (important as this is) does not answer the questions of what novices should be taught and how they should be prepared. There are two interrelated problems here: (a) Most of this research describes teacher thinking, planning, and decision making without taking an empirically supported position on the effectiveness or desirability of these forms and patterns of teacher thinking; and, (b) even if these forms of teacher thinking are shown to be desirable for teachers, it remains to be discovered how one might best help start inexperienced prospective teachers moving in these directions.

3. Particular changes and improvements made in the content and process of teacher preparation ought to be invented, tested, and adapted by teacher educators themselves. Research on teacher thinking can provide examples of concepts, methods, and food for thought for teacher educators but not well-defined prescriptions for how to educate teachers. (The ideal situation,

from my point of view, is when researchers on teacher thinking themselves become practicing teacher educators and learn how to apply their research to their own teaching.)

4. Fourth, and finally, I believe that research on teacher thinking has already begun to affect the ways we think and act as we prepare novices for the teaching profession. Teacher educators are asking thoughtful questions about the content and process of their work, and, in the last five years, a number of interesting and encouraging program innovations have been started with still more in the planning stages. To date, research on teacher thinking has perhaps affected the ways in which teachers are prepared more visibly than it has affected the ways teachers teach in classrooms.

Thinking From the Research

Suppose that a researcher on teacher thinking is invited to consult with a faculty of teacher educators. What could he or she offer as food for thought to these teacher educators as they think about strengthening their own teacher preparation program? I want to describe a handful of ideas from research on teacher thinking that such a consultant could offer in response to the teacher educators' needs. I group these ideas under three headings: Implicit Theories and Preconceptions, Planning and Reflection, and Uncertainty and Dilemmas.

Implicit Theories and Preconceptions

Research on teacher thinking has documented the fact that teachers develop and hold implicit theories about their students (Bussis, Chittenden, & Amarel, 1976), about the subject matter that they teach (Ball, 1986; Duffy, 1977; Elbaz, 1981; Kuhs, 1980) and about their roles and responsibilities and how they should act (Ignatovich, Cusick, & Ray, 1979; Olson, 1981). These implicit theories are not neat and complete reproductions of

the educational psychology found in textbooks or lecture notes. Rather, teachers' implicit theories tend to be eclectic aggregations of cause-effect propositions from many sources, rules of thumb, generalizations drawn from personal experience, beliefs, values, biases, and prejudices. Teachers are subject to the full range of insights and errors in human judgment (described by Nisbett & Ross, 1980), just as all humans are when faced with complex, fast-paced, consequential, and occasionally emotion-laden social judgments and action situations. And teachers' implicit theories about themselves and their work are thought to play an important part in the judgments and interpretations that teachers make every day.

As the term "implicit theory" implies, these systems of thought are not clearly articulated or codified by their owners but are typically inferred and reconstructed by researchers on teacher thinking. The study of implicit theories employs various methods including stimulated recall interviews, linguistic analysis of teacher talk, paragraph completion tests, responses to simulation materials such as vignettes describing hypothetical students or classroom situations, and concept generation and mapping exercises such as the Kelly Repertory Grid Technique. Research designs also vary considerably from ethnographic case studies of one or two teachers (Clandinin, 1986; Elbaz, 1981; Kroma, 1983) to standardized administration of a belief inventory, judgment task, or stimulated recall protocol to several teachers (e.g., Conners, 1978; Marland, 1977; Munby, 1983). Variability in researchers' methods, designs, contexts, and interpretive frames of reference leads to great variability in how teachers' implicit theories are described.

Leaving teachers and their implicit theories for a moment, let me turn to research that is primarily about students learning science. Studies of the teaching and learning of science (e.g., Roth, 1985; Roth, Smith, &

Anderson, 1983) indicate that students come to a science lesson or course with preconceptions about the phenomena and processes in the science curriculum. For example, fifth graders come to a lesson on photosynthesis with their own ideas about how plants get nourishment or to a physics unit on light and vision with preconceptions about how we see. Often, these preconceptions are incomplete, flawed, and in conflict with currently accepted scientific explanations. And almost always, students' preconceptions are robust, that is, students continue to hold and think from flawed but familiar preconceptions about the world even after having been taught scientifically correct explanations (Roth, 1985). Researchers advocating an approach to teaching called "teaching for conceptual change" (Posner, Strike, Hewson, & Gertzog, 1982; Roth, 1985) have demonstrated that students' preconceptions can be revised or replaced with scientifically correct conceptions only if considerable teaching time and energy are devoted to unmasking and incontrovertibly confronting students' misconceptions before proceeding with instruction.

So, back in our consultant role, what do we have to work with, in the service of teacher educators? Teachers have implicit theories, students have preconceptions. Both are robust, idiosyncratic, sensitive to the particular experiences of the holder, incomplete, familiar, and sufficiently pragmatic to have gotten the teacher or student to where they are today. Neither are likely to read like a textbook or to be quickly and thoroughly replaced by the usual lecture, reading, discussion, practice, and evaluation methods typically employed in teacher preparation programs. Implicit theories and preconceptions affect perception, interpretation, and judgment and therefore have potentially important consequences in what teachers and students do and say.

In the context of teacher education I believe these claims and information about implicit theories and preconceptions have some interesting and provocative implications. Students begin teacher education programs with their own ideas and beliefs about what it takes to be a successful teacher. These preconceptions are formed from thousands of hours of observation of teachers, good and bad, over the previous fifteen or so years. Undoubtedly, students' conceptions of teaching are incomplete, for they typically see and hear only the performance side of classroom teaching. With this in mind, a thoughtful teacher educator might ask: What are the preconceptions about teaching and learning held by our students? How should we take account of what our students know and believe as we help them prepare to be teachers? How might we structure field observations early in a teacher preparation program to make visible important aspects of teaching not usually obvious to primary school or high school students? What do prospective teachers believe about the integration of subject matter knowledge with pedagogical skills, and what does our preparation program offer to support or challenge and replace these preconceptions? Notice that these are not questions to which research on teacher thinking offers answers. But rather these are potentially useful questions that might not otherwise have been asked in the absence of research on teacher thinking.

Beyond pursuing answers to questions about prospective teachers, this research can stimulate introspective questions about teacher educators themselves. What do we as teacher educators believe about teaching and learning, individually and as a faculty? How consistent are our espoused beliefs with our methods of teaching and evaluation? (that is, do we practice what we preach?) Are the implicit and explicit theories of teacher educators who supervise practice teaching likely to dominate and wash out what has been

taught earlier in a teacher preparation program? How does variability in implicit theories among supervisors of practice teaching influence and bias their judgments and evaluations of our students?

Asking questions like these has led a number of teacher educators to take the risky and exciting step of systematically studying their own practices. For example, a few studies of the influence of implicit theories and belief systems of clinical supervisors on their judgments of student teachers have been completed recently (Niemeyer & Moon, 1986; Rust, 1986). These studies have contributed to deliberation about who should be doing clinical observations (i.e., Should this usually low-status task be delegated to inexperienced graduate assistants, to experienced teachers hired for these purposes, to experienced teacher educators, experts in the academic disciplines, or teams from two or three of these groups?), how clinical observations should be done, what kinds of evidence might be used in student teacher evaluation, and how clinical supervisors might prepare themselves for their important and demanding work. This research has also begun to contribute to an enhanced sense of professional identity among teacher educators who specialize in clinical supervision, insofar as it has demonstrated the complexity and intellectual demands of this aspect of teacher education and drawn attention to the potentially pivotal role of the clinical supervisor in the process of teacher preparation.

Planning and Reflection

Research on teacher planning consists of a score or more of studies every bit as variable in method and design as the work on implicit theories. Two distinctive features, however, set planning apart from implicit theories. First, virtually everyone involved with education agrees that planning is a real phenomenon, that is, all teachers do something they call

planning at some times. And second, many now see teacher planning as the instrumental linking process between curriculum on the one hand and the particulars of instruction on the other.

Psychologically, to understand teacher planning is to understand how teachers transform and interpret knowledge, formulate intentions, and act from that knowledge and those intentions. From the curriculum theorist's point of view, the study of teacher planning can help explain why and how curriculum materials are understood or misunderstood, used, distorted, ignored, or transcended in classroom instruction. Politically and administratively, to control teacher planning is to control, in large measure, the content, pace, emphasis, and process of instruction. And, from the practicing teacher's point of view, the study of teacher planning can enhance appreciation of the genuinely professional (as distinct from technical) aspects of teaching; that is, the study of teacher planning can and has documented the many heretofore unappreciated ways in which the practice of teaching can be as complex and cognitively demanding as the practice of medicine, law, or architecture.

I know that those of us who began to do research on teacher planning 10 or 12 years ago did not anticipate that this work had potential for being so central to the concerns of so many audiences. It has only been in hindsight that I have come to believe that to understand teacher planning is to understand teaching; that the study of how teachers prepare for instruction can reveal a great deal about which features of subject matter, students, and of the physical, psychological, administrative, and political environments actually influence classroom instruction. We can theorize with the best of intentions about how teaching and school learning could be optimized, but our finest ideas and proposals must still pass through the funnel of teacher planning.

After this big buildup, I am a bit embarrassed to admit that research on teacher thinking has made only modest beginnings in the study of teacher planning. We know, for example, that experienced teachers do several different types of planning in the course of the school year (Clark & Yinger, 1979), that the time-honored rational model (moving from learning objectives, through generating alternatives, to choice of an optimal alternative) is not used regularly by experienced teachers (Morine-Dershimer & Vallance, 1976; Yinger, 1977) (Although experienced teachers do claim that the rational model ought to be taught to novices; see Neale, Case, & Pace, 1983). Teachers do attend to learning outcomes, sometimes prior to teaching (while planning), sometimes during teaching, and sometimes only after interactive teaching is over (McLeod, 1981). Teachers also attend to goals, issues, and concerns other than learning outcomes in their planning. And the teacher planning process serves immediate personal purposes for teachers, such as study of content, anxiety reduction, and confidence building, as well as longer range instrumental purposes, determining the content and structure of classroom interaction (Carnahan, 1980; Hill, Yinger, & Robbins, 1981; Peterson, Marx, & Clark, 1978).

Psychological models of the planning process have been proposed and, to some degree, tested against the realities of practice (e.g., Clark & Yinger, 1979; Yinger, 1977). And styles of planning used by experienced teachers such as "incremental planning" and "comprehensive planning" (Clark & Yinger, 1979) have been described. Curriculum planning has been shown to vary with the subject matter under consideration and with the degree of novelty or familiarity of the material, students, and teaching setting (Clark & Elmore, 1981). American elementary teachers report spending relatively large amounts of time planning (10 to 20 hours per week) but also report that

relatively little time or support for planning are officially sanctioned or encouraged (Clark & Yinger, 1979). An important product of the planning process is routines (Yinger, 1979) or structured patterns of teacher and student behavior. The first weeks of the school year have been shown to be a particularly important period for teacher planning, inasmuch as many of the routines, rules, relationships, and expectations that influence classroom interaction during the remainder of the year are planned, negotiated, replanned, and established during that time (Anderson & Evertson, 1978; Buckley & Cooper, 1978; Clark & Elmore, 1979; Shultz & Florio, 1979; Tikunoff & Ward, 1978).

In the process of reviewing the literature of research on teacher thinking several times (e.g., Clark, 1983; Clark & Peterson, 1986; Clark & Yinger, 1977), I have come to both bless and curse a distinction made by Philip Jackson almost two decades ago--the distinction between preactive teacher behavior and interactive teaching (Jackson, 1968). On the side of blessings and gratitude, this distinction serves me well as an analytic tool for defining the boundary between studies of teacher planning (preactive teaching) and studies of teacher interactive thinking and behavior. If no students are physically present, we are dealing with preactive teaching; and if students are present, we are dealing with interactive teaching. The distinction is clear, simple, and has great face validity--the empty classroom is clearly a different place from the classroom populated with teacher and students engaged in the business of teaching and learning.

But, more recently, this distinction has given me pause, and even trouble. For, whereas much of teacher planning begins and ends in the empty classroom, I have come to believe that planning does not stop when students arrive, that teachers can plan and revise plans "on their feet," and that reflection on plans and on classroom experiences can be an important

influence on teacher planning--no matter when that reflection takes place. Teacher thinking is both more messy and more integrated (in the person of the teacher) than Jackson's neat distinction suggests. The iterative and social nature of teaching allows and encourages revision, postponement, elaboration, or abandonment of yesterday's plan in response to today's experience in the classroom. The distinctions between planning and teaching, between preactive and interactive thinking, begin to blur and become fuzzy. There is a danger of forcing the phenomenology of teaching to fit models and categories of researchers, possibly distorting and misunderstanding the essential richness and dynamism of teacher thinking. The study of reflection, post-hoc analysis, and response to apparent failures; of interruptions, negotiations, teaching disasters, and desperate inspirations may contribute as much to understanding planning and teaching as the direct study of preparing for instruction.

One of the side effects of doing research on teacher thinking has been the discovery and elaboration of techniques and procedures for promoting reflection and analysis by teachers of their own thinking and behavior. These techniques include journal keeping, clinical interviewing, stimulated recall procedures in which teachers view videotape recordings (or sometimes listen to audiotapes) of their teaching and respond to questions about their thinking, perceptions, decisions and intentions, and concept-generation and conceptual-mapping tasks. To study teacher thinking researchers must depend on teachers to think aloud, either while in the act of thinking and deciding, or retrospectively; we cannot observe thought directly.

Hand in glove with these technical developments is the development of a commitment to including teachers themselves as full partners in the study of teacher thinking. To some degree, this change in the role that teachers

play in the research process from experimental subject to colleague and collaborator follows from the invisible nature of teacher thinking and from the model role of the "informant" in ethnographic studies of societies linguistically and culturally different from that of the anthropologist. And, in part, the enhanced role of teachers in research on teacher thinking reflects ideological and political commitments to share power more equitably between the communities of research and of practice. In any case, teachers have found themselves thinking aloud, reflecting, raising, and refining questions about their knowledge and practice; writing; analyzing data; making formal presentations of research in which they have been involved; and publishing for audiences of researchers and teachers. A great deal of this has happened in the last eight years, and these developments are due largely to the advent of research on teacher thinking (Porter, 1986).

While working with teachers on research projects in these ways, I noticed a recurring theme in our conversations that concerns the powerful effects on teachers of reflecting on their own practice. Experienced teachers report that describing their plans and intentions, explaining their reasons underlying action and decision, and responding to the questions and presence of an informed, nonjudgmental adult seems to breathe new life and meaning into their teaching. Usually, teaching is an action-oriented, operational, "don't look back, they may be gaining on you" profession. But the intervention of researchers describing planning, thinking, and decision making has required that teachers stop and think, find words and reasons for their thoughts and beliefs, and take a second look at themselves and their teaching.

Although not intended by the researchers as professional development activities, the journal keeping, clinical interviews, stimulated recall sessions, and articulation of beliefs and implicit principles of practice

have instigated a new awareness among a few teachers. These techniques and the genuine human interest in understanding that accompany their use may constitute professional development activities of the broadest kind--that is, they may enable teachers to see and appreciate what is genuinely professional about their work; to kindle or revive the idealism, freshness, and commitment to self-improvement that we often see in the best first-year teachers, but this time, with a difference: the difference that years of accumulated practical wisdom brings. In sum, reflection by teachers makes a difference, albeit a difference expressed in many different ways.

Now, what does this mix of fact, theory, and opinion say to our consultant, trying to be helpful to teacher educators? He or she might bring questions like these to deliberations about teacher preparation: When and how do prospective teachers learn about and practice planning? How many kinds of planning do they practice? To what extent does their practice planning take account of the structural and practical differences between school subject matters (e.g., the concept of "guided practice" may be realized in quite different ways in the contexts of essay writing or math problem solving)? Is the theory and practice of planning as expressed in university courses consistent with the procedures and criteria for successful planning built into the practice teaching experience? What do our approaches to training teachers to plan reveal about our implicit theories of teaching (e.g., teaching as literal implementation of curriculum materials, as imitation of experienced models, as curriculum building and adaptation, as behavior management)? If planning during the first days and weeks of the school year is so important, do our prospective teachers ever get to see and participate in this kind of planning?

To what extent do our teacher education students have opportunities to plan, teach, replan, and reteach, thus learning about the limits of foresight and about improvement-oriented self-observation? Do we include techniques and opportunities for reflection and professional communication among teachers in our training programs? And how do we, the teacher educators, show that we value and practice reflection and self-examination about our own teaching? Again, our researcher-consultant brings no crisp and prescriptive answers to these questions. But they are questions worth pursuing, and the pursuit must be framed by the all-important context of particular professional preparation programs. Teacher planning and reflection are not the whole of teaching, but research on teacher thinking suggests to me that they deserve explicit and creative attention throughout a sound teacher education program.

Uncertainty and Dilemmas

The third set of contributions of research on teacher thinking to discourse about teacher preparation concerns the very nature of the teaching situation itself--not "what works," but "what it is really like out there," as seen through the eyes of teachers themselves. In three words, teaching as experienced is complex, uncertain, and peppered with dilemmas.

The research on teacher planning alluded to above speaks eloquently to the complexity and uncertainty inherent in interactive teaching. Indeed, a great deal of teachers' planning energy goes into trying to predict and anticipate potential problems, guess and estimate what students already know and how they might respond, and to forming plans and routines that are robust to the interruptions and distractions that assault most teachers most of the time.

Researchers have also studied the thinking and decision making that teachers do during the act of teaching. This research has explored the extent to which teachers make on-the-spot decisions that change their plans or behavior in the classroom, and attempted to identify the cues used by teachers in reaching these interactive decisions. A few studies have explored the relationships between patterns of interactive decision making and student achievement, and some compare thinking processes of experts with those of novices in the same situations. Like the literature on teacher planning, the number of studies available is small and the teachers studied are mostly experienced elementary school teachers.

Research on interactive decision making indicates that teachers encounter decision situations at two-minute intervals while teaching--literally hundreds of decision points per day. This research also indicates that the greatest proportion of teachers' interactive thoughts is about students (between 39% and 50%), followed by instructional behavior and procedures, content, materials, and learning objectives (Peterson & Clark, 1978). Marland (1977) categorized teachers' interactive thoughts as perceptions, interpretations, anticipations, and reflections. There is some evidence to support the idea that teachers consider improvising major changes in instructional process primarily when their teaching is going poorly; that is, when the myriad adjustments and small changes that teachers make in the ongoing classroom process prove insufficient in maintaining the flow of the lesson (Peterson & Clark, 1978). This is consistent with findings from studies of the cognitive processing of professionals in other fields who are described by Simon (1957) as pursuing a strategy of "satisficing" rather than optimizing. Research by Doyle (1979) also indicates that it is "adaptive and efficient for a teacher to direct conscious processing primarily to discrepancies or anomalies. By specializing in discrepancies, a teacher can

anticipate disruptions and reduce the effects of immediacy and unpredictability on task accomplishment" (Doyle, 1979, pp. 62-63).

Leinhardt and Greeno (1984) describe the cognitive structures that teachers use to move back and forth between implementing planned routines and adjusting their actions to new information that becomes available in the course of a lesson. They found experienced teachers to be distinguished by their ability to obtain and retain new information in interaction with students while continuing to maintain control of their agenda. Others have compared the schema that experienced teachers use to understand what is happening in the classroom with the way novices understand the same situation (Calderhead, 1983; Housner & Griffey, 1983).

Three studies examined the relationship between interactive decision making and student on-task behavior or achievement (Doyle, 1977; Morine & Vallance, 1975; Peterson, Marx, & Clark, 1978). The interactive decision making of effective teachers is characterized by rapid judgment, "chunking" of many events and cues into a few categories, differentiation of cues and events as to their importance, and a willingness to change the course of classroom interaction when necessary. The studies of teacher planning and decision making tell us a great deal about the task demands of teaching as well as about how particular teachers cope with those demands. The task environment of the classroom has been characterized by Shulman (1984) as more complex than that faced by a physician in a diagnostic examination. This complexity has been described by Clark and Lampert (1986, p. 28) as follows:

> The teacher encounters a host of interrelated and competing decision situations both while planning and during teaching. There are no perfect or optimal solutions to these decisions. A gain for one student or in one subject matter may mean a foregone opportunity for others. A motivationally and intellectually profitable digression may reduce time devoted

> to the mandated curriculum. Such conflicts among teachers' multiple commitments lead to practical dilemmas (Berlak & Berlak, 1981; Lampert, 1984) which must be managed in interaction with students. Conflicting goals, combined with endemic uncertainty about how to achieve desired outcomes can lead to "knots" in teachers' thinking (Wagner, 1984). Often these entanglements can only be sorted out as the teacher experiments with action and observes its outcomes (Lampert, 1985). By such experimentation, teachers build a store of personal practical knowledge about how to get their job done (Clandinin & Connelly, 1984).

So, research on teacher thinking has made an empirical case that the practice of teaching is complex, uncertain, and dilemma-riddled. And this research has described how some teachers see, feel, and cope with the grayness. What questions might our hypothetical consultant raise with teacher educators that follow from seeing teaching thus? First, one might ask how thoroughly and persuasively a teacher preparation program informs its postulants that there is more to teaching than meets the eye; that expertise in teaching is less a matter of knowing all the answers than a matter of making the most of the unexpected. Whereas the system of education in China supports the role of the teacher as a virtuoso who creates, practices, and polishes exquisitely set pieces of pedagogical performance (Paine, 1986), the teacher in American schools is faced with a mind-boggling array of mutually incompatible expectations and imperatives.

Do prospective teachers hear this, come to believe this, and take it into account in forming their emergent expectations and implicit theories? Do methods courses, microteaching, and other preparatory experiences reflect the intrinsic uncertainty of teaching? Or do teacher education programs control, oversimplify, and distort practice teaching and field observation experiences to such a degree that our students' practice time is wasted or misdirected in irrelevant and unrepresentative test-like activities? Do the teachers of teachers have the courage to think aloud as they themselves wrestle with troubling dilemmas about depth versus breadth of content

studied, distribution of time and attention among individual students, making inferences about what students know and what grades they should be assigned?

Do we claim to be graduating fully functioning teachers or novices well started? How might teacher preparation programs be sowing the seeds of learned helplessness and incompetence by advocating practices that simply do not work for novices? For example, teacher educators in two otherwise exemplary preparation programs (studied by Ball & Feiman-Nemser, 1986) taught their students that good teachers don't use published textbooks or basal readers, they create their own materials. This well-intentioned advice set up students for failure and embarrassment during practice teaching because the teacher preparation program did not equip these beginners to create original materials of high quality and practicality and because their experienced cooperating teachers typically relied on textbooks and basal readers quite heavily. Here we have a case of unintentional sabotage of a potentially crucial learning experience.

I will say one final time that research on teacher thinking does not promise to discover a generically effective method or set of techniques for dealing with uncertainty, complexity, or dilemmas. By their very natures these qualities defy the quest for a technical fix. But I do claim that the teacher educator who tells it like it is, who abandons the fiction that teaching can become a technically exact scientific enterprise, and who has the courage to reveal how he or she agonizes over real dilemmas and contradictions--that teacher educator is likely to be successful at helping prospective teachers to prepare themselves for uncertainty. That teacher educator is likely to minimize the boredom and burnout that plague our profession. That teacher educator is asking the right questions about teacher preparation.

Conclusion

Teacher preparation is already being affected, to some degree, by research on teacher thinking. Thoughtful teacher educators are learning about this research, thinking from it, and asking questions about the ways in which they help their students become well-started and thoughtful novice teachers. Research on teacher thinking has helped us to appreciate in some detail the complexity, artistry, and demandingness of classroom teaching. And this work now serves as rich food for thought (and action) for colleagues who have chosen the challenging work of influencing the knowledge, skills, and dispositions of those who would teach. I hope that this great conversation broadens and continues, with researchers, teacher educators, and those who play both roles pursuing answers to the big question: How can we help our students to prepare themselves to think and act in ways that will eventually become good teaching?

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